Rayat Shikshan Sanstha's

Sadguru Gadage Maharaj College, Karad

(An Autonomous College, Affiliated to Shivaji University, Kolhapur.)

NEP-2020: Credit Framework for Faculty of Science

Single Major and Minor

2023-24

Syllabus for Bachelor of Science (Electronics) Part I

1. **SUBJECT: Electronics**

2. **YEAR OF IMPLEMENTATION:** New Syllabi for the B.Sc. I Electronics will be implemented from Academic year 2023-24 according to NEP-2020 onwards.

3. **PREAMBLE:**

   Bachelor degree in Electronics is an integrated academic degree in faculty of Science. The faculty is not ignoring the developments in the field of Electronics. The revision of existing syllabus of Electronics subject in science faculty is essential according to the norms given in NEP-2020. This is a humble endeavor to initiate the process towards an era of knowledge. The students from this faculty should also be competent for this change in the technology.

   In this year, a student will able to understand handling of laboratory equipments, build Electronics circuits with confidence. In the subject, the student will also get a basic and proper knowledge in the field of Embedded System design, IOT, PCB design and Robotics.

4. **GENERAL OBJECTIVES OF THE COURSE:**
   1. To create graduates with sound knowledge of fundamentals of Electronics, who can contribute towards advancing science and technology.
   2. To create graduates with sufficient capabilities in Electronics who can become researchers and developers to satisfy the needs of the core Electronics industry.
   3. To develop ability among students to formulate, analyze and solve real life problems faced in Electronics industry.
   4. To provide opportunity to students to learn the latest trends in Electronics and make them ready for life-long learning process.
   5. To make the students aware of professional ethics of the Industry, and prepare them with basic soft skills essential for working in community and professional teams.
   6. To prepare the students for graduate studies through competitive examinations, enabling them to reach higher echelons of excellence
   7. To produce electronic professionals who can be directly employed or start his/her own work as Electronic circuit Designer, Electronics consultant, testing professional, Service engineer and even an entrepreneur in electronic industry.

5. **DURATION:**

   3 or 4 Years (Full Time)

6. **PATTERN:**

   SEMESTER EXAM

7. **MEDIUM OF INSTRUCTIONS: ENGLISH**

STRUCTURE OF COURSE:

DSC (Discipline Specific Course) Major

1. FIRST SEMESTER

Sr. No.	SUBJECT TITLE	Theory			Practical		
		Paper No. & Paper Code	No. of lectures Per week	Credits		No. of lectures Per week	Credits
1	Electronics	Paper-I MJ-BET23-101	5	4	Practical MJ-BEP23-103	4	2
		Paper-II: MJ-BET23-102					

2. SECOND SEMESTER

Sr. No.	SUBJECT TITLE	Theory			Practical		
		Paper No. & Paper Code	No. of lectures Per week	Credits		No. of lectures Per week	Credits
1	Electronics	Paper-III: MJ-BET23-201	5	4	Practical MJ-BET23-203	4	2
		Paper-IV: MJ-BET23-202					

3. Structure and Title of Papers of B. Sc. Course:

- **B. Sc. I Semester I**

Paper I: **Analog Electronics-I**
Paper II: **Digital Electronics-I**

- **B. Sc. I Semester II**

Paper III: **Analog Electronics-II**
Paper IV: **Digital Electronics-II**

4. OTHER FEATURES:

A. <u>LIBRARY:</u>

- **REFERENCE BOOKS**

1. R. S. Sedha, Textbook of Applied Electronics, S. Chand Publication
2. Soni and Gupta, Network Analysis,
3. S. A. Nasar, Electric Circuits, Schaum's outline series, Tata McGraw Hill (2004)

4. Electrical Circuits, M. Nahvi and J. Edminister, Schaum's Outline Series, Tata McGraw-Hill.(2005)
5. Robert L. Boylestad, Essentials of Circuit Analysis, Pearson Education (2004)
6. W. H. Hayt, J. E. Kemmerly, S. M. Durbin, Engineering Circuit Analysis, Tata McGraw Hill(2005)
7. Alexander and M. Sadiku, Fundamentals of Electric Circuits , McGraw Hill (2008)
8. S. M. Sze, Semiconductor Devices: Physics and Technology, 2nd Edn, Wiley India edition (2002).
9. Ben G Streetman and S. Banerjee, Solid State Electronic Devices, Pearson Education (2006)
10. Dennis Le Croissette, Transistors, Pearson Education (1989)
11. Jasprit Singh, Semiconductor Devices: Basic Principles, John Wiley and Sons (2001)
12. Kanaan Kano, Semiconductor Devices, Pearson Education (2004)
13. Robert F. Pierret, Semiconductor Device Fundamentals, Pearson Education (2006)
14. M. Morris Mano Digital System Design, Pearson Education Asia, (Fourth Edition)
15. Thomas L. Flyod, Digital Fundamentals, Pearson Education Asia (1994)
16. W. H. Gothmann, Digital Electronics: An Introduction To Theory And Practice, Prentice Hall of India(2000)
17. R. L. Tokheim, Digital Principles, Schaum's Outline Series, Tata McGraw- Hill (1994)
18. Electronic Devices and circuit theory, Robert Boylestad and Louis Nashelsky, 9th Edition, 2013, PHI
19. Electronic devices, David A Bell, Reston Publishing Company
20. D. L. Schilling and C. Belove, Electronic Circuits: Discrete and Integrated, Tata McGraw Hill (2002)
21. Donald A. Neamen, Electronic Circuit Analysis and Design, Tata McGraw Hill (2002)
22. J. Millman and C. C. Halkias, Integrated Electronics, Tata McGraw Hill (2001)
23. J. R. C. Jaegar and T. N. Blalock, Microelectronic Circuit Design, Tata McGraw Hill (2010)
24. J. J. Cathey, 2000 Solved Problems in Electronics, Schaum's outline Series, Tata McGraw Hill (1991)
25. Allen Mottershed, Electronic Devices and Circuits, Goodyear Publishing Corporation

B. Sc. Part – I Semester – I Paper I
MJ-BET23-101: ANALOG ELECTRONICS-I
Theory: 30 hrs. (38 lectures of 48 minutes)
Marks-50 (**Credits: 02)**

Course Outcomes:

After the completion of the course the student will be able to:

CO1: Identify and explain electrical components and determine the value of resistor, inductor and capacitor using color code method.
CO2: Understand the basic properties of electrical elements, and solve DC circuit analysis problems, DC network theorems.
CO3: Acquire the knowledge about the characteristics and working principles of PN junction diode, Zener diode, photo diode, LED and different diode applications.
CO4: Understanding and study of rectifier, filter and voltage regulator circuits

Unit -1: Basic Circuit Elements: **(9 Lectures)**

Study of basic circuit elements and passive components: Resistor, Capacitor, Inductor, Transformer, Relays, Switches (working principle, circuit symbols, types, specifications and applications).

Unit -2: Circuit Analysis: **(10 Lectures)**

Concept of Voltage and Current Sources, Internal resistance, Kirchhoff's Current Law, Kirchhoff's Voltage Law, Mesh Analysis, Node Analysis, Principle of Duality, Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer Theorem, Millman's Theorem. (Numericals expected)

Unit -3: PN Junction Diode: **(9 Lectures)**

Construction of PN junction, Formation of Depletion Layer, Barrier potential, Forward and Reverse bias, Diode Equation and I-V characteristics, Zener diode, Zener and Avalanche breakdown, Zener diode specifications. Photo diode. Light Emitting Diode (LED): construction and working, 7-segment display and it's applications.

Unit-4: DC Power Supply: **(10 Lectures)**

Need of Power Supply, Block diagram of DC regulated power supply, Rectifiers: Half wave, Full wave rectifiers (center tapped and bridge):- Circuit diagrams, working and waveforms, ripple factor, PIV, efficiency and TUF. Filter-Shunt capacitor filter, Series inductor filter, π - filter. Regulation: Concept of Line and load regulation, Zener diode as voltage regulator, Three pin IC regulators: Block diagram, Specifications and applications. Fixed and Variable voltage IC regulator (IC 78xx,79xx and LM317). Concept of SMPS.

B. Sc. Part – I Semester – I Paper-II

MJ-BET23-102: DIGITAL ELECTRONICS-I

Theory: 30 hrs. (37 lectures of 48 minutes)

Marks-50 (**Credits: 02)**

Course Outcomes:

After the completion of the course the student will be able to:

CO1: Understanding the basics of Digital Electronics, different number systems, Binary Codes and signed representation of binary number. Also understand the conversion between different number systems and solve the binary arithmetic problems.

CO2: Design and construction of the basic and universal logic gates and studying the Boolean algebra and simplification of Boolean expression using different methods.

CO3: Understanding and comparing different logic families according IC specifications and their circuit configurations.

CO4: Understand, analyze and design various combinational circuits.

Unit-1: Number System, Codes and Binary Arithmetic: (**10 Lectures**)

Decimal, Binary, Octal and Hexadecimal number systems and their inter conversions. BCD code. ASCII code, Gray Code, Excess-3 Code, Bar code, QR code, Binary Arithmetic: Addition, Subtraction by 1's complement and2's complement method, Representation of signed and unsigned numbers,

Unit-2: Logic Gates, Boolean algebra: ` (**9 Lectures**)

Study of logic Gates: OR, AND, NOT, NOR, NAND,XOR, XNOR, Universal Gates, Boolean identities and Law's, fundamental theorems of Boolean algebra. Standard representation of logic functions (SOP and POS), Minimization Techniques (Karnaugh map minimization up to 4 variables for SOP).

Arithmetic Circuits: Binary Addition. Half and Full Adder. Half and Full Subtractor, 4-bit binary Adder/Subtractor.

Unit- 3: Logic Families (**10 Lectures**)

Logic Families: Types of Logic Families, Characteristics of Logic Families, TTL NAND gate, TTL NOR gate, TTL NOT gate, Concept of Tristate Logic, MOS Technology, CMOS: NOR, NAND and NOT gates, Comparison of TTL and CMOS logic families.

Unit-4: Combinational circuits: (**8 Lectures**)

Multiplexers: - 2 to 1, 4 to 1 and 8 to 1. Demultiplexers : - 1 to 2, 1 to 4, 1 to 8. Encoder: concept of encoder, Decimal to BCD Encoder. Basic Binary decoders: 2 to 4 line, 3 to 8 line and 4 to 16 line, BCD to decimal decoder, Study of BCD to seven-segment decoder driver IC 7447.

PRACTICAL PAPER – I and II
Credits: 02
Based on MJ-BEP23-103
ELECTRONICS LAB
(At least 10 experiments)

1. To familiarize with basic electronic components (R, C, L, diodes, transistors), Digital Multimeter, Function Generator, power supplies and Oscilloscope etc.
2. Measurement of Amplitude, Frequency & Phase difference using Oscilloscope.
3. Verification of Thevenin`s Theorem.
4. Verification of Norton`s Theorem.
5. Verification of Superposition Theorem.
6. Study of the I-V Characteristics of P-N junction Diodes.
7. Study of the a] breakdown Characteristics of Zener Diode
   b] Zener Diode as voltage regulator.
8. Study of Half wave and Full wave rectifier (centre tapped transformer /bridge)
9. Study of Logic Gates.
10. Study of Universal Gates using fundamental gates.
11. Study of De-Morgans Theorems.
12. Study of Half Adder and Full Adder
13. Study of Half Subtractor
14. Study of BCD to seven segment Decoder.
15. Study of Multiplexer (4:1) and Demultiplexer (1:4)

Any 02 from the followings Computer Simulations

1. Study the effect of (a) C- filter and (b) Zener regulator on the output of FWR
2. Verification of the Norton and Thevenin's Theorems.
3. Study any Boolean expression using K-map.

B. Sc. Part – I Semester – II PAPER-III
MJ-BET23-201: ANALOG ELECTRONICS-II
Theory: 30 hrs. (38 lectures of 48 minutes)
Marks-50 (**Credits: 02)**

Course Outcomes:

After the completion of the course the student will be able to:

- **CO1:** Analyze output in different operating modes of Bipolar Junction Transistor and Demonstrate the operating principle and output characteristics of Bipolar Junction Transistor
- **CO2:** Explain construction and characteristics of JFETs, MOSFETs and UJT.
- **CO3:** Design biasing circuits for BJT and study different coupling methods used in multistage amplifiers
- **CO4:** Analyze the importance of feedback in amplifiers. Apply the knowledge gained in the design of transistorized circuits and Oscillators.

Unit-1: Bipolar Junction Transistor: **(10 Lectures)**

BJT: Introduction, Structure, Working of transistor. Transistor configurations: CB, CE and CC configurations, characteristics of transistor in CE and CB configurations, Regions of operation (active, cut off and saturation), Current gains α and β. Relations between α and β, dc load line and Q point (Operating point), Significance of Q-point.

Unit-2: Unipolar Devices: **(8 Lectures)**

JFET: Construction, working and I-V characteristics (output and transfer), MOSFET: Construction, working and I-V characteristics (output and transfer).UJT: introduction, structure and characteristics.

Unit-3 Amplifiers: **(10 Lectures)**

Need of transistor Biasing, Transistor biasing and Stabilization circuits- Fixed Bias and Voltage Divider Bias. Thermal runaway, stability and stability factor S., Class A, B, AB and C Amplifiers (Comparative Study on the basis of Q point), Single stage CE amplifier: Current gain, Voltage gain, Power gain, input and output resistances, frequency Response.

Cascaded Amplifiers: Two stage RC, LC, TC and DC Coupled Amplifiers and their Frequency Responses. Concept of Differential amplifier and its advantages.

Unit-4: Feedback Amplifier and Oscillators: **(10 Lectures)**

Concept of feedback, negative and positive feedback, advantages of negative feedback (Qualitative only).

Oscillators: Barkhausen criterion for sustained oscillations. Phase shift, Wien Bridge, Hartley and Colpitt's oscillator .UJT as relaxation oscillator.

B. Sc. Part – I Semester – II PAPER-IV
MJ-BET23-202: DIGITAL ELECTRONICS-II
Theory: 30 hrs. (38 lectures of 48 minutes)
Marks-50 (**Credits: 02)**

Course Outcomes:

After the completion of the course the student will be able to:

- **CO1:** Understand, analyze and design various sequential circuits.
- **CO2:** Understanding the working of different shift registers and counters.
- **CO3:** Became able to know various types of analog to digital converters and digital to analog converters.
- **CO4:** Understanding of clock and clock circuit, operation of digital circuits with different applications.

Unit-1: Sequential Circuit: (**10 Lectures**)

Concept of Flip-flop, RS, D and JK Flip-Flops, Concept of Clock, Level and Edge Triggered RS,D, JK Flip-flop, Preset and Clear operations. Race-around conditions in JK Flip-Flop, Master- slave JK Flip-Flop, T-Flip-flop

Unit-2: Shift registers and Counters (**10 Lectures**)

Concept of register, Left shift and Right Shift operations, Types of shift registers: SISO, SIPO, PISO & PIPO (only up to 4 bits).

Counters: classification of counter**s,** Asynchronous counters: 3 bit ripple counter, Decade Counter. Synchronous Counter: 3 bit and decade synchronous counter. Ring Counter and Johnson Counter. Applications of Counters.

Unit-3: Data Converters (**9 Lectures**)

4 bit binary weighted and R-2R ladder network DAC: circuit and working. DAC Characteristics: Accuracy and Resolution. ADC: Counter type, successive approximation, Flash ADC, ADC Characteristics .

Unit-4: Applications of Digital Circuit (**9 Lectures**)

Clock generation using logic gate, Study of IC 7495/595, Application of counter (object counter/ digital clock/digital tachometer) Flasher circuit using gates, concept of timer and it's applications.

Semester – II PRACTICAL
Credits 02
Semester- II
MJ-BEP23-203
(At least 10 experiments)

1. Study of I-V Characteristics of JFET.
2. Study of Input, Output and transfer Characteristics of CE configuration of BJT
3. Study of Voltage divider bias circuit for CE mode.
4. Design of a Single Stage CE amplifier of given gain
5. Study of the RC Phase Shift Oscillator.
6. Study of the Wien Bridge Oscillator.
7. Study the Colpitt`s oscillator.
8. Study the Hartley oscillator.
9. Building and testing of RS Flip-Flop using NAND/NOR gate.
10. Building and testing D and JK Flip-Flop using IC
11. Construction and study of Shift Register (SISO) using D-type/ JK Flip-Flop ICs
12. Design and study of 4 bit digital to analog converter using R-2R ladder network.
13. Design and study of an Astable Multivibrator using IC 555 Timer.
14. Design and study of a Monostable Multivibrator using IC 555 Timer.
15. Design and study of a Bistable Multivibrator using IC 555 Timer.

SPICE/MULTISIM simulations for electronic circuits and devices
AT LEAST 02 EXPERIMENTS FROM THE FOLLOWING
Any 02 from the followings computer simulations

1. Design clocked SR and JK Flip-Flops using Gates.
2. Design 4-bit asynchronous counter using Flip-Flop ICs.
3. Design a Counter type ADC

STRUCTURE OF COURSE:

DSE (Discipline Specific Elective) Minor

1. FIRST SEMESTER

Sr. No.	SUBJECT TITLE	Theory			Practical		
		Paper No. & Paper Code	No. of lectures Per week	Credits		No. of lectures Per week	Credits
1	Electronics	Paper-III: MN-BET23-101	5	4	Practical MN-BEP23-103	4	2
		Paper-IV: MN-BET23-102					

2. SECOND SEMESTER

Sr. No.	SUBJECT TITLE	Theory			Practical		
		Paper No. & Paper Code	No. of lectures Per week	Credits		No. of lectures Per week	Credits
1	Electronics	Paper-III: MN-BET23-201	5	4	Practical MN-BEP23-203	4	2
		Paper-IV: MN-BET23-202					

3. Structure and Title of Papers of B. Sc. Course:

B. Sc. I Semester I

Paper I: Analog Electronics-I

Paper II: Digital Electronics-I

B. Sc. I Semester II

Paper III: Analog Electronics-II

Paper IV: Digital Electronics-II

4. OTHER FEATURES:

1. R. S. Sedha, Textbook of Applied Electronics, S. Chand Publication
2. Soni and Gupta, Network Analysis,
3. S. A. Nasar, Electric Circuits, Schaum's outline series, Tata McGraw Hill (2004)
4. Electrical Circuits, M. Nahvi and J. Edminister, Schaum's Outline Series, Tata

McGraw-Hill.(2005)
5. Robert L. Boylestad, Essentials of Circuit Analysis, Pearson Education (2004)
6. W. H. Hayt, J. E. Kemmerly, S. M. Durbin, Engineering Circuit Analysis, Tata McGraw Hill(2005)
7. Alexander and M. Sadiku, Fundamentals of Electric Circuits , McGraw Hill (2008)
8. S. M. Sze, Semiconductor Devices: Physics and Technology, 2nd Edn, Wiley India edition (2002).
9. Ben G Streetman and S. Banerjee, Solid State Electronic Devices, Pearson Education (2006)
10. Dennis Le Croissette, Transistors, Pearson Education (1989)
11. Jasprit Singh, Semiconductor Devices: Basic Principles, John Wiley and Sons (2001)
12. Kanaan Kano, Semiconductor Devices, Pearson Education (2004)
13. Robert F. Pierret, Semiconductor Device Fundamentals, Pearson Education (2006)
14. M. Morris Mano Digital System Design, Pearson Education Asia, (Fourth Edition)
15. Thomas L. Flyod, Digital Fundamentals, Pearson Education Asia (1994)
16. W. H. Gothmann, Digital Electronics: An Introduction To Theory And Practice, Prentice Hall of India(2000)
17. R. L. Tokheim, Digital Principles, Schaum's Outline Series, Tata McGraw- Hill (1994)
18. Electronic Devices and circuit theory, Robert Boylestad and Louis Nashelsky, 9th Edition, 2013, PHI
19. Electronic devices, David A Bell, Reston Publishing Company
20. D. L. Schilling and C. Belove, Electronic Circuits: Discrete and Integrated, Tata McGraw Hill (2002)
21. Donald A. Neamen, Electronic Circuit Analysis and Design, Tata McGraw Hill (2002)
22. J. Millman and C. C. Halkias, Integrated Electronics, Tata McGraw Hill (2001)
23. J. R. C. Jaegar and T. N. Blalock, Microelectronic Circuit Design, Tata McGraw Hill (2010)
24. J. J. Cathey, 2000 Solved Problems in Electronics, Schaum's outline Series, Tata McGraw Hill (1991)
25. Allen Mottershed, Electronic Devices and Circuits, Goodyear Publishing Corporation

B. Sc. Part – I Semester – I Paper I
MN-BET23-101: ANALOG ELECTRONICS-I
Theory: 30 hrs. (38 lectures of 48 minutes)
Marks-50 (**Credits: 02)**

Course Outcomes:

After the completion of the course the student will be able to:

CO1: Identify and explain electrical components and determine the value of resistor, inductor and capacitor using color code method.

CO2: Understand the basic properties of electrical elements, and solve DC circuit analysis problems, DC network theorems.

CO3: Acquire the knowledge about the characteristics and working principles of PN junction diode, Zener diode, photo diode, LED and different diode applications.

CO4: Understanding and study of rectifier, filter and voltage regulator circuits

Unit -1: Basic Circuit Elements: **(9 Lectures)**

Study of basic circuit elements and passive components: Resistor, Capacitor, Inductor, Transformer, Relays, Switches (working principle, circuit symbols, types, specifications and applications).

Unit -2: Circuit Analysis: **(10 Lectures)**

Concept of Voltage and Current Sources, Internal resistance, Kirchhoff's Current Law, Kirchhoff's Voltage Law. Mesh Analysis. Node Analysis. Principle of Duality, Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer Theorem, Millman's Theorem. (Numericals expected)

Unit -3: PN Junction Diode: **(9 Lectures)**

Construction of PN junction, Formation of Depletion Layer, Barrier potential, Forward and Reverse bias, Diode Equation and I-V characteristics, Zener diode, Zener and Avalanche breakdown, Zener diode specifications. Photo diode. Light Emitting Diode (LED): construction and working, 7-segment display and it's applications.

Unit-4: DC Power Supply: **(10 Lectures)**

Need of Power Supply, Block diagram of DC regulated power supply, Rectifiers: Half wave, Full wave rectifiers (center tapped and bridge):- Circuit diagrams, working and waveforms, ripple factor, PIV, efficiency and TUF. Filter-Shunt capacitor filter, Series inductor filter, π - filter. Regulation: Concept of Line and load regulation, Zener diode as voltage regulator, Three pin IC regulators: Block diagram, Specifications and applications. Fixed and Variable voltage IC regulator (IC 78xx,79xx and LM317). Concept of SMPS.

B. Sc. Part – I Semester – I Paper-II

MN-BET23-102: DIGITAL ELECTRONICS-I

Theory: 30 hrs. (37 lectures of 48 minutes)

Marks-50 (**Credits: 02)**

Course Outcomes:

After the completion of the course the student will be able to:

CO1: Understanding the basics of Digital Electronics, different number systems, Binary Codes and signed representation of binary number. Also understand the conversion between different number systems and solve the binary arithmetic problems.

CO2: Design and construction of the basic and universal logic gates and studying the Boolean algebra and simplification of Boolean expression using different methods.

CO3: Understanding and comparing different logic families according IC specifications and their circuit configurations.

CO4: Understand, analyze and design various combinational circuits.

Unit-1: Number System, Codes and Binary Arithmetic: (**10 Lectures**)

Decimal, Binary, Octal and Hexadecimal number systems and their inter conversions. BCD code. ASCII code, Gray Code, Excess-3 Code, Bar code, QR code, Binary Arithmetic: Addition, Subtraction by 1's complement and2's complement method, Representation of signed and unsigned numbers,

Unit-2: Logic Gates, Boolean algebra: ` (**9 Lectures**)

Study of logic Gates: OR, AND, NOT, NOR, NAND, XOR, XNOR, Universal Gates, Boolean identities and Law's, fundamental theorems of Boolean algebra. Standard representation of logic functions (SOP and POS), Minimization Techniques (Karnaugh map minimization up to 4 variables for SOP).

Arithmetic Circuits: Binary Addition. Half and Full Adder. Half and Full Subtractor, 4-bit binary Adder/Subtractor.

Unit- 3: Logic Families (**10 Lectures**)

Logic Families: Types of Logic Families, Characteristics of Logic Families, TTL NAND gate, TTL NOR gate, TTL NOT gate, Concept of Tristate Logic, MOS Technology, CMOS: NOR, NAND and NOT gates, Comparison of TTL and CMOS logic families.

Unit-4: Combinational circuits: (**8 Lectures**)

Multiplexers: - 2 to 1, 4 to 1 and 8 to 1. Demultiplexers : - 1 to 2, 1 to 4, 1 to 8. Encoder: concept of encoder, Decimal to BCD Encoder. Basic Binary decoders: 2 to 4 line, 3 to 8 line and 4 to 16 line, BCD to decimal decoder, Study of BCD to seven-segment decoder driver IC 7447.

Semester – I PRACTICAL
Credits: 02
Based on MN-BET23-103
ELECTRONICS LAB
(At least 10 experiments)

1. To familiarize with basic electronic components (R, C, L, diodes, transistors), Digital Multimeter, Function Generator, power supplies and Oscilloscope etc.
2. Measurement of Amplitude, Frequency & Phase difference using Oscilloscope.
3. Verification of Thevenin`s Theorem.
4. Verification of Norton`s Theorem.
5. Verification of Superposition Theorem.
6. Study of the I-V Characteristics of P-N junction Diodes.
7. Study of the a] breakdown Characteristics of Zener Diode b] Zener Diode as voltage regulator.
8. Study of Half wave and Full wave rectifier (centre tapped transformer /bridge)
9. Study of Logic Gates.
10. Study of Universal Gates using fundamental gates.
11. Study of De-Morgans Theorems.
12. Study of Half Adder and Full Adder
13. Study of Half and Full Subtractor
14. Study of BCD to seven segment Decoder.
15. Study of Multiplexer (4:1) and Demultiplexer (1:4)

Any 02 from the followings Computer Simulations

1. Study the effect of (a) C- filter and (b) Zener regulator on the output of FWR
2. Verification of the Norton and Thevenin's Theorems.
3. Study any Boolean expression using K-map.

B. Sc. Part – I Semester – II PAPER-III
MN-BET23-201: ANALOG ELECTRONICS-II
Theory: 30 hrs. (38 lectures of 48 minutes)
Marks-50 (**Credits: 02)**

Course Outcomes:

After the completion of the course the student will be able to:

- **CO1:** Analyze output in different operating modes of Bipolar Junction Transistor and Demonstrate the operating principle and output characteristics of Bipolar Junction Transistor
- **CO2:** Explain construction and characteristics of JFETs, MOSFETs and UJT.
- **CO3:** Design biasing circuits for BJT and study different coupling methods used in multistage amplifiers
- **CO4:** Analyze the importance of feedback in amplifiers. Apply the knowledge gained in the design of transistorized circuits and Oscillators.

Unit-1: Bipolar Junction Transistor: **(10 Lectures.)**
BJT: Introduction, Structure, Working of transistor. Transistor configurations: CB, CE and CC configurations, characteristics of transistor in CE and CB configurations, Regions of operation (active, cut off and saturation), Current gains α and β. Relations between α and β, dc load line and Q point (Operating point), Significance of Q-point.

Unit-2: Unipolar Devices: **(8 Lectures.)**
JFET: Construction, working and I-V characteristics (output and transfer), MOSFET: Construction, working and I-V characteristics (output and transfer).UJT: introduction, structure and characteristics.

Unit-3 Amplifiers: **(10 Lectures.)**
Need of transistor Biasing, Transistor biasing and Stabilization circuits- Fixed Bias and Voltage Divider Bias. Thermal runaway, stability and stability factor S., Class A, B, AB and C Amplifiers (Comparative Study on the basis of Q point), Single stage CE amplifier: Current gain, Voltage gain, Power gain, input and output resistances, frequency Response.
Cascaded Amplifiers: Two stage RC, LC, TC and DC Coupled Amplifiers and their Frequency Responses. Concept of Differential amplifier and its advantages.

Unit-4: Feedback Amplifier and Oscillators: **(10 Lectures.)**
Concept of feedback, negative and positive feedback, advantages of negative feedback (Qualitative only).
Oscillators: Barkhausen criterion for sustained oscillations. Phase shift, Wein Bridge, Hartley and Colpitt's oscillator .UJT as relaxation oscillator.

B. Sc. Part – I Semester – II PAPER-IV
MN-BET23-202 :DIGITAL ELECTRONICS-II
Theory: 30 hrs. (38 lectures of 48 minutes)
Marks-50 (**Credits: 02)**

Course Outcomes:

After the completion of the course the student will be able to:

- **CO1:** Understand, analyze and design various sequential circuits.
- **CO2:** Understanding the working of different shift registers and counters.
- **CO3:** Became able to know various types of analog to digital converters and digital to analog converters.
- **CO4:** Understanding of clock and clock circuit, operation of digital circuits with different applications.

Unit-1: Sequential Circuit: (**10 Lectures**)

Concept of Flip-flop, RS, D and JK Flip-Flops, Concept of Clock, Level and Edge Triggered RS,D, JKFF, Preset and Clear operations. Race-around conditions in JK Flip-Flop, Master- slave JK Flip-Flop, T-Flip-flop

Unit-2: Shift registers and Counters (**10 Lectures**)

Concept of register, Left shift and Right Shift operations, Types of shift registers: SISO, SIPO, PISO & PIPO (only up to 4 bits).

Counters**:** classification of counter**s,** Asynchronous counters: 3 bit ripple counter, Decade Counter. Synchronous Counter: 3 bit and decade synchronous counter. Ring Counter and Johnson Counter. Applications of Counters.

Unit-3: Data Converters (**9 Lectures**)

4 bit binary weighted and R-2R ladder network DAC: circuit and working. DAC Characteristics: Accuracy and Resolution. ADC: Flash, Counter type, successive approximation ADC, ADC Characteristics .

Unit-4: Applications of Digital Circuit (**9 Lectures**)

Clock generation using logic gate, Study of IC 7495/595, Application of counter (object counter/ digital clock/digital tachometer) Flasher circuit using gates, concept of timer and it's applications.

Semester – II PRACTICAL
(Maximum Marks: 50) (Credits 02)
Semester- II
MN-BEP23-203
(At least 10 experiments)

1. Study of I-V Characteristics of JFET.
2. Study of Input , Output and transfer Characteristics of CE configuration of BJT
3. Study of Voltage divider bias circuit for CE mode.
4. Design of a Single Stage CE amplifier of given gain
5. Study of the RC Phase Shift Oscillator.
6. Study of the Wein Bridge Oscillator.
7. Study the Colpitt`s oscillator oscillator.
8. Study the Hartley oscillator.
9. Building and testing of RS Flip-Flop using NAND/NOR gate.
10. Building and testing D and JK Flip-Flop using IC
11. Construction and study of Shift Register (Serial-in and serial-out) using D-type/ JK Flip-Flop ICs
12. Design and study of 4 bit digital to analog converter using R-2R ladder network.
13. Design and study of an Astable Multivibrator using IC 555 Timer.
14. Clock generator using logic gate.

SPICE/MULTISIM simulations for electronic circuits and devices
AT LEAST 02 EXPERIMENTS FROM THE FOLLOWING
Any 02 from the followings computer simulations

1. Design clocked SR and JK Flip-Flops using Gates.
2. Design 4-bit asynchronous counter using Flip-Flop ICs.
3. Design a Counter type ADC

Evaluation Scheme

For both DSC and DSE (Major and Minor)

Semester I

Semester End Examination (SEE)

Paper I and II : 40 Marks each

Continuous and Comprehensive Evaluation (CCE)

Internal 10 Marks each

Semester wise Practical Exam

Semester II

Semester End Examination (SEE)

Paper III and IV : 40 Marks each

Continuous and Comprehensive Evaluation (CCE)

Internal 10 Marks each

Semester wise Practical Exam

NEP-2020: Credit Framework for Faculty of Science

Open Elective (OE)

2023-24

Syllabus (Electronics) Part I

1. FIRST SEMESTER

Sr. No.	SUBJECT TITLE	Theory			Practical		
		Paper No. & Paper Code	No. of lectures Per week	Credits		No. of lectures Per week	Credits
1	Electronics	Paper-I GE-BET23-101	5	4	Practical GE-BEP23-103	4	2
		Paper-II: GE-BET23-102					

2. SECOND SEMESTER

Sr. No.	SUBJECT TITLE	Theory			Practical		
		Paper No. & Paper Code	No. of lectures Per week	Credits		No. of lectures Per week	Credits
1	Electronics	Paper-III: GE-BET23-201	5	4	Practical GE-BEP23-203	4	2
		Paper-IV: GE-BET23-202					

3. Structure and Title of Papers Course:

- **B. Sc. I Semester I**

Paper I: Basic Circuit Theory and Network Analysis
Paper II: Digital Techniques-I

- **B. Sc. I Semester II**

Paper III: Semiconductor Devices
Paper IV: Digital Techniques-II

B. Sc. Part – I Semester – I Paper I

GE-BET23-101: Basic Circuit Theory and Network Analysis

Theory: 30 hrs. (38 lectures of 48 minutes)

Marks-50 (**Credits: 02)**

Course Outcomes:

After the completion of the course the student will be able to:

CO1: Identify and explain electrical components and determine the value of resistor, inductor and capacitor using color code method.

CO2: Understand the basic properties of electrical elements, and solve DC circuit analysis problems, DC network theorems.

CO3: Understand the AC signal, Basic measurement and types os sinusoidal and non-sinusoidal signal

CO4: Understanding and study of network, load calculation of load requirements.

Paper -I

Unit -1: Basic Circuit Elements: (10 Lectures.)

Study of basic circuit elements and passive components: Resistor, Capacitor, Inductor, Transformer, Relays, Switches (working principle, circuit symbols, types, specifications and applications), Types of wire used for practical and other applications, Color code method for resistance calculation.

Unit -2: DC Circuit Analysis: **(9 Lectures.)**

Concept of voltmeter, current meter, Ohm's law, Kirchhoff's Current law, Kirchhoff's Voltage law, Examples, Measurement of resistance using ohm meter, Node and Mesh Analysis, RC charging and discharging, Star and Delta network conversion,

Unit -3: AC Circuit Analysis: **(9 Lectures.)**

Concept of Voltage and Current Sources, Internal resistance, concept of AC signal, Amplitude and frequency of signal, Phase measurement, Types of signal, Concept of phase , neutral and earthing, Measurement of AC signal, Use of multimeter.

Unit-4: Basic Circuits. (10 Lectures.)

Series and parallel connection of resistor and capacitor, voltage and current divider circuit, Specifications of battery, series and parallel connection of Battery, Charging circuit, Power calculation for given load, construction of wiring for one and two way connection, concept of solar panel, Inverter.

B. Sc. Part – I Semester – I Paper-II

GE-BET23-102: DIGITAL TECHINQUES-I

Theory: 30 hrs. (38 lectures of 48 minutes)

Marks-50 (**Credits: 02)**

Course Outcomes:

After the completion of the course the student will be able to:

CO1: Understanding the basics of Digital Electronics, different number systems, Binary Codes and signed representation of binary number. Also understand the conversion between different number systems and solve the binary arithmetic problems.

CO2: Design and construction of the basic and universal logic gates and studying the Boolean algebra and simplification of Boolean expression using different methods.

CO3: Understanding and comparing different logic families according IC specifications and their circuit configurations.

CO4: Understand, analyze and design various combinational circuits.

Unit-1: Number System, Binary Codes and Binary Arithmetic: (**14 Lectures**)
Decimal, Binary, Octal and Hexadecimal number systems and their inter conversions. BCD code. ASCII code, Gray Code, Excess-3 Code, Binary Arithmetic: Addition, Subtraction of binary numbers, Subtraction by 1's complement and 2's complement method, Representation of signed and unsigned numbers,

Unit-2: Logic Gates, Boolean algebra: ` (**14 Lectures**)
Study of logic Gates: OR, AND, NOT, NOR, NAND,XOR, XNOR, Universal Gates, Boolean identities and Law's, fundamental theorems of Boolean algebra. Standard representation of logic functions (SOP and POS), Minimization Techniques (Karnaugh map minimization up to 4 variables for SOP).

Arithmetic Circuits: Binary Addition. Half and Full Adder. Half and Full Subtractor, 4-bit binary Adder/Subtractor.

Unit-3: Combinational circuits: (**10 Lectures**)
Multiplexers: - 2 to 1, 4 to 1 and 8 to 1. Demultiplexers : - 1 to 2, 1 to 4, 1 to 8. Encoder: concept of encoder, Decimal to BCD Encoder. Basic Binary decoders: 2 to 4 line, 3 to 8 line and 4 to 16 line, BCD to decimal decoder, Study of BCD to seven-segment decoder driver IC 7447.

PRACTICAL PAPER – I and II
Credits: 02
GE-BEP23-103
ELECTRONICS LAB
(At least 10 experiments)

1. To familiarize with basic electronic components (R, C, L, diodes, transistors), Digital Multimeter, Function Generator, power supplies and Oscilloscope etc.
2. Measurement of Amplitude, Frequency & Phase difference using Oscilloscope.
3. Study of Voltage and current divider rule.
4. Study of batteries.
5. Study of Logic Gates.
6. Study of Universal Gates using fundamental gates.
7. Study of De-Morgans Theorems.
8. Study of Half Adder and Full Adder
9. Study of Half Subtractor
10. Study of BCD to seven segment Decoder.
11. Study of Multiplexer (4:1) and Demultiplexer (1:4)

B. Sc. Part – I Semester – II PAPER-III
GE-BET23-201: Semiconductor Devices
Theory: 30 hrs. (38 lectures of 48 minutes)
Marks-50 (**Credits: 02)**

Course Outcomes:

After the completion of the course the student will be able to:

CO1: Analyze output in different operating modes of Bipolar Junction Transistor and Demonstrate the operating principle and output characteristics of Bipolar Junction Transistor

CO2: Explain construction and characteristics of JFETs, MOSFETs and UJT.

CO3: Design biasing circuits for BJT and study different coupling methods used in multistage amplifiers

CO4: Analyze the importance of feedback in amplifiers. Apply the knowledge gained in the design of transistorized circuits and 0scillators.

Unit-1: PN Junction Diode: **(10 Lectures)**

Construction of PN junction, Formation of Depletion Layer, Barrier potential, Forward and Reverse bias, Diode Equation and I-V characteristics, Zener diode, Zener and Avalanche breakdown, Zener diode specifications. Photo diode. Light Emitting Diode (LED): construction and working, 7-segment display and it's applications.

Unit-2: DC Power Supply: **(12 Lectures)**

Need of Power Supply, Block diagram of DC regulated power supply, Rectifiers: Half wave, Full wave rectifiers (center tapped and bridge):- Circuit diagrams, working and waveforms, ripple factor, PIV, efficiency and TUF. Filter-Shunt capacitor filter, Series inductor filter, π - filter. Regulation: Concept of Line and load regulation, Zener diode as voltage regulator, Three pin IC regulators: Block diagram, Specifications and applications. Fixed and Variable voltage IC regulator (IC 78xx,79xx and LM317).

Unit-3: Bipolar Junction Transistor: **(8 Lectures)**

BJT: Introduction, Structure, Working of transistor. Transistor configurations: CB, CE and CC configurations, characteristics of transistor in CE and CB configurations, Regions of operation (active, cut off and saturation), Current gains α and β. Relations between α and β, dc load line and Q point (Operating point), Significance of Q-point.

Unit-4 Amplifiers: **(8 Lectures)**

Need of transistor Biasing, Transistor biasing and Stabilization circuits- Fixed Bias and Voltage Divider Bias. Thermal runaway, Classification of Amplifiers Class A, B, AB and C Amplifiers (Comparative Study on the basis of Q point), Single stage CE amplifier: Current gain, Voltage gain, Power gain, input and output resistances, frequency Response, Concept of Oscillator.

B. Sc. Part – I Semester – II PAPER-IV
GE-BET23-202: DIGITAL ELECTRONICS-II
Theory: 30 hrs. (38 lectures of 48 minutes)
Marks-50 (**Credits: 02)**

Course Outcomes:

After the completion of the course the student will be able to:

CO1: Understand, analyze and design various sequential circuits.

CO2: Understanding the working of different shift registers and counters.

CO3: Became able to know various types of analog to digital converters and digital to analog converters.

CO4: Understanding of Basic components of computer with different specification.

Unit-1: Sequential Circuit: (**10 Lectures**)

Concept of Flip-flop, RS, D and JK Flip-Flops, Concept of Clock, Level and Edge Triggered RS,D, JKFF, Preset and Clear operations. Race-around conditions in JK Flip-Flop, Master- slave JK Flip-Flop, T-Flip-flop

Unit-2: Shift registers and Counters (**8 Lectures**)

Concept of register, Left shift and Right Shift operations, Types of shift registers: SISO, SIPO, PISO & PIPO (only up to 4 bits).

Counters: classification of counter**s,** Asynchronous counters: 3 bit ripple counter, Decade Counter. Synchronous Counter: 3 bit and decade synchronous counter. Ring Counter and Johnson Counter. Applications of Counters.

Unit-3: Data Converters (**9 Lectures**)

4 bit binary weighted and R-2R ladder network DAC: circuit and working. DAC Characteristics: Accuracy and Resolution. ADC: Flash, Counter type, successive approximation ADC, ADC Characteristics.

Unit-4: Computer and Peripheral Devices (**9 Lectures**)

Block diagram of computer system, Memory, Types of memory, I/O peripheral devices, Concept of interfacing, Types of ports, CCTV.

Semester – II PRACTICAL

Credits:02

Semester- II

GE-BEP23-203

(At least 10 experiments)

1. Study of the I-V Characteristics of P-N junction Diodes.
2. Study of the a] breakdown Characteristics of Zener Diode

   b] Zener Diode as voltage regulator.
3. Study of Half wave and Full wave rectifier (centre tapped transformer)
4. Study of Bridge rectifier.
5. Study of Input, Output and transfer Characteristics of CE configuration of BJT
3. Study of Voltage divider bias circuit for CE mode.
4. Design of a Single Stage CE amplifier of given gain
5. Study of the RC Phase Shift Oscillator.
6. Study of the Wien Bridge Oscillator.
7. Building and testing of RS Flip-Flop using NAND/NOR gate.
8. Building and testing D and JK Flip-Flop using IC
9. Construction and study of Shift Register (Serial-in and serial-out) using D-type/ JK Flip-Flop ICs
10. Design and study of 4 bit digital to analog converter using R-2R ladder network.
11. CCTV installation.

Evaluation Scheme

For Open Elective (OE)

Semester I

Semester End Examination (SEE)

Paper I and II : 40 Marks each

Continuous and Comprehensive Evaluation (CCE)

Internal 10 Marks each

Semester wise Practical Exam

Semester II

Semester End Examination (SEE)

Paper III and IV : 40 Marks each

Continuous and Comprehensive Evaluation (CCE)

Internal 10 Marks each

Semester wise Practical Exam

Rayat Shikshan Sanstha's

Sadguru Gadage Maharaj College, Karad

(An Autonomous College, Affiliated to Shivaji University, Kolhapur.)

NEP-2020: Credit Framework for Faculty of Science

Department of Electronics

Semester I

Indian Knowledge System (IKS)

IKSE23-101

Fundamental concepts of Yoga

Credit:02

Course Outcomes:

Students will have an understanding of Yoga, its origin

Students get the knowledge history and development of Yoga.

Get introduction of Yoga according to various texts.

Unit I: General Introduction of Yoga and Yogis (10)

Meaning, Definition, Nature of Yoga, importance of yoga, Misconceptions related with Yoga, Maharishi Patanjali, Gorakshanath, Maharishi Dayananda Saraswati, Swami Vivekananda, Sri Aurobindo.

Unit II: Nature (12)

Nature of Yoga in various scriptures: Vedas, Upanishads, Bhagwad Gita, Yoga Vashistha, Jainism, Buddhism, Sankhya Shastra, Vedanta, Tantra Shastra, Ayurveda.

Unit III: Types of Yoga (8)

Types of Yoga: Jnana Yoga, Bhakti Yoga, Karma Yoga, Hatha Yoga, Raja Yoga

References:

YogVidnyan : Swami Vidnyanand Swarsvati
Sachitra Yogapradipika : B. K. S . Ayyanger
Yoga ChaitanyaPradipika : Yogacharya Dr. Raparthi Ramarao
Bharat ke Sant Mahatma: Ramalal

Rayat Shikshan Sanstha's

Sadguru Gadage Maharaj College, Karad

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NEP-2020: Credit Framework for Faculty of Science

Department of Electronics

Semester II

Skill Enhancement Course (SEC)

SECE23-201

Electric Wiring

Credit:02

List of Practical's:

1) Study of Wires and switches.

2) Study of electrical instruments (Multimeter, Tom Tester etc.)

3) Study of tester, high voltage measuring devices.

4) Measurement of DC and AC voltage (small voltage).

5) Study of various requirements for fitting(MCB, phase, neutral and earthing)

6) Construction of small AC circuit

7) Design of electrical circuit using two way switch

8) Construction of extension board with socket, switch, indicator and fuse.

9) Calculation of load in VA and Watt form, selection of fuse.

10) Construction of home light fitting.

11) Design and construction of DC power supply.

BOS Chairman,
Department of Electronics

Principal,
Sadguru Gadage Maharaj College, Karad.